

1. A device for moving a blade on an earth-moving machine, said device comprising:
  - a first actuator configured to move a first side of said blade;
  - a second actuator configured to move a second side of said blade; and
  - a controller configured to permit either manual or automatic operation of said actuators
- 5 such that said actuators are responsive to said controller to move said blade in a linked mode such that both sides of said blade move substantially in unison with one another, said controller comprising:
  - at least one user-operable input mechanism to facilitate said manual operation of
  - said actuators;
  - 10 an information processor to facilitate said automatic operation of said actuators;
  - and
  - an output configured to display information pertaining to a position of said blade.
2. The device according to claim 1, wherein said output is configured to display a single
- 15 blade position value.
3. The device according to claim 1, further comprising a laser guidance apparatus comprising:
  - a signal source configured to provide a reference signal to said controller; and
  - 20 a plurality of detectors configured to be in signal communication with said source and said controller such that in either said manual or automatic operation, said actuators can move said blade in response to a difference between said reference signal and said blade position.
4. A control system for a machine tool, said system comprising:
  - 25 a plurality of actuators configured to move said tool; and
  - a guidance apparatus cooperative with said actuators, said guidance apparatus comprising:
    - a signal source;
    - a plurality of detectors configured to be in signal communication with said source;
    - 30 and

a controller configured to control said plurality of actuators while operating in one of a plurality of operational modes, said controller comprising:

- a data interface coupled to said detectors;
- at least one user-operable input mechanism;
- an information processor responsive to said input mechanism; and
- an output configured to display information in each of said plurality of operational modes,

said control system configured such that while said controller is in a first of said plurality of operational modes, each of said actuators is driven by said controller independently of one another, while in a second of said plurality of operational modes, said plurality of actuators are responsively linked such that they are driven in unison with one another.

5. The control system according to claim 4, wherein said signal source is an electromagnetic radiation source.

6. The control system according to claim 5, wherein said electromagnetic radiation source is a laser source.

7. The control system according to claim 4, wherein said actuators, while being driven in said second operational mode, are together responsive to a single input into said input mechanism to enable purely translational movement of said tool.

8. The control system according to claim 7, wherein said purely translational movement is along a substantially vertical direction.

9. The control system according to claim 7, wherein when said control system is operating in said second mode, said output is configured to display a single elevation number corresponding to a position of said tool relative to said signal source.

10. The control system according to claim 4, wherein said information processor is CPU-based.

11. The control system according to claim 4, wherein said information displayed by said output in said first operational mode comprises a plurality of elevation numbers corresponding to said tool.

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12. The control system according to claim 4, wherein said information displayed by said output in said second operational mode comprises a single elevation number corresponding to said tool.

10 13. The control system according to claim 4, wherein said guidance apparatus further comprises a plurality of masts connected to said tool, each said mast coupled to one of said detectors and configured to maintain said detector in said signal communication with said signal source.

15 14. The control system according to claim 13, wherein during said second operational mode, said actuators are configured to move said tool in response to a deviation sensed between at least one of said detectors and either a laser plane established by said signal source or a user-defined offset that has been input into said controller.

20 15. The control system according to claim 14, wherein during said second operational mode with said controller in signal communication with said source, said actuators continue to respond to said controller in unison with one another even when one of said detectors is no longer signally coupled to said source.

25 16. A linked mode blade control system comprising:  
a plurality of actuators configured to move said blade at a predetermined slope orientation throughout the substantial entirety of a blade lift travel path; and  
a guidance apparatus cooperative with said actuators, said guidance apparatus comprising:

30 a signal source;



a plurality of detectors configured to be in signal communication with said source;  
and

a controller configured to control said plurality of actuators while operating in  
said linked mode, said controller comprising:

5 a data interface coupled to said detectors;

at least one user-operable input mechanism; and

an information processor responsive to said input mechanism; and

an output responsive to said controller and configured to display information in  
said linked mode such that said information displayed by said output in  
10 said linked mode comprises a single elevation number corresponding to a  
position of said blade within said lift travel path.

17. The blade control system of claim 16, wherein said predetermined slope orientation of  
said blade is relative to a laser plane established by said signal source or a user-defined offset  
15 that has been input into said controller.

18. An earth-grading apparatus comprising:

a blade;

an assembly configured to move said blade; and

20 a guidance apparatus cooperative with said assembly, said guidance apparatus  
comprising:

a signal source;

a plurality of detectors configured to be in signal communication with said source;  
and

25 a controller configured to control said assembly while operating in a plurality of  
operational modes, said controller comprising:

a data interface coupled to said detectors;

at least one user-operable input mechanism;

an information processor responsive to said input mechanism; and

30 an output configured to display information in either of said  
plurality of operational modes,

said apparatus configured such that when said controller is in a first of said plurality of operational modes, each of said actuators is driven by said controller independently of one another, while in a second of said plurality of operational modes, said plurality of actuators are responsively linked such that they are driven in unison with one another.

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19. The apparatus according to claim 18, wherein said signal source is a laser source.

20. The apparatus according to claim 18, wherein said actuators, while being driven in said second operational mode, are together responsive to a single user input into said input  
10 mechanism to enable either purely translational blade movement.

21. The apparatus according to claim 20, wherein said single user input is an elevation offset, said offset defined by a relative position between said blade and a laser plane established by said signal source.

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22. The apparatus according to claim 18, wherein said guidance apparatus further comprises a plurality of masts mounted to said blade, each said mast coupled to one of said detectors and configured to maintain said detector in said signal communication with said signal source.

20 23. The apparatus according to claim 22, wherein said masts are longitudinally spaced along said blade.

24. The apparatus according to claim 23, wherein a first of said masts is mounted to a right side of said blade, and where a second of said masts is coupled to either a left side or center  
25 section of said blade.

25. A method of operating an earth-grading apparatus, said method comprising the steps of: configuring said earth-grading apparatus to include:

30 a blade;  
an assembly configured to move said blade; and

a guidance apparatus cooperative with said assembly, said guidance apparatus comprising a signal source, a plurality of detectors signally coupled to said source, a plurality of masts, each coupled to one of said detectors and configured to facilitate signal communication between said detector and said signal source, and a controller configured to control said assembly while operating in a plurality of operational modes, said controller comprising:

- a data interface coupled to said detectors;
- at least one user-operable input mechanism;
- an information processor responsive to said input mechanism; and
- an output configured to display information in either of said plurality of operational modes;

selecting from a plurality of operational modes available on said system, wherein a first mode enables actuators making up said assembly to be driven by said controller independently of one another, and wherein a second mode enables said actuators to be responsively linked such that they are driven in unison with one another; and

inputting instructions into said input mechanism commensurate with said operational mode.

26. The method according to claim 25, wherein said signal source is a laser.

27. The method according to claim 26, wherein said step of selecting comprises selecting said second operational mode.

28. The method according to claim 27, wherein said step of inputting comprises inputting a single elevational number.

29. The method according to claim 28, comprising the additional steps of:

comparing at least one of a laser plane reference elevation established by said laser or a user-defined offset that has been input into said controller to a present elevational position of said blade;

determining whether a deviation exists between said present elevational position of said blade and at least one of said reference elevation or said offset; and  
positioning said blade in response to said deviation.

5     30.     The method according to claim 29, wherein said comparing, determining and positioning steps are all performed automatically.

31.     A method of benchmarking an earth-grading apparatus, said method comprising the steps of:

10     configuring said earth-grading apparatus to include:

        a blade;

        a plurality of actuators to move said blade; and

        a guidance apparatus cooperative with said actuators, said guidance apparatus comprising a signal source, a plurality of detectors signally coupled to said source, and a controller configured to operate in at least a linked mode, said controller comprising:

                a data interface coupled to said detectors;

                at least one user-operable input mechanism;

                an information processor responsive to said input mechanism; and

20                 an output configured to display information in said linked mode;

        providing a benchmark at a location accessible to said blade;

        positioning said blade substantially on said benchmark;

        transmitting a signal with said source;

        inputting instructions into said input mechanism; and

25     receiving said signal with at least one of said detectors until a setpoint is established by at least one of said detectors.

32.     The method of claim 31, further comprising configuring said guidance apparatus to include a plurality of masts, each coupled to one of said detectors to enable at least translational  
30     movement thereof to facilitate said establishment of said setpoint.

33. The method of claim 31, wherein said positioning said blade substantially on said benchmark comprises positioning a portion of said blade that is substantially underneath one of said detectors substantially on said benchmark.

5 34. The method of claim 33, wherein said portion of said blade that is substantially underneath one of said detectors is a right side or a left side.

35. The method of claim 31, wherein said inputting instructions comprises initiating a search for said transmitted signal by at least one of said detectors.

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36. The method of claim 31, further comprising displaying on said output a single reference elevation corresponding to either said setpoint or a deviation therefrom.